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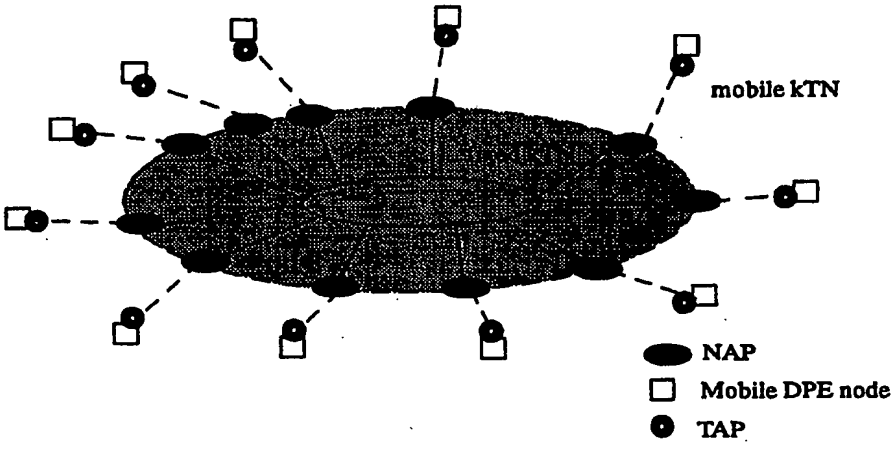

The kTN consisting of a fixed and a mobile part

(57) Abstract

The present invention relates to an arrangement for improving availability of services in a communications system, especially a telecommunications system, said system comprising distributed hardware and software components which interact in order to provide services to one or more users, and in order to implement this improvement the present invention suggests the introduction in said system of a terminal mobility, for thereby enabling application availability including inter alia terminal mobility. More specifically the present invention suggests implementations of a terminal mobility support introduced for distributed systems, and more specifically by implementing this terminal mobility support by the division of the kernel Transport Network into a fixed and a mobile part, and by using two agents. One on the fixed part representing the mobile DPE node and another one on the mobile DPE representing the fixed part of the kernel Transport Network.

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ARRANGEMENT FOR IMPROVING AVAILABILITY OF SERVICES IN A COMMUNICATION SYSTEM

FIELD OF THE INVENTION

Generally, the present invention relates to an arrangement for improving availability of services in a communications system, especially a telecommunications system, said system comprising distributed hardware and software components which interact in order to provide services to one or more users.

More specifically the present invention relates to the improvement of such availability of services in all forms of terminal mobility.

Further, the present invention finds specific utilisation in connection with terminal mobility support in distributed systems, and even more specifically the mechanisms for such terminal mobility support in distributed systems.

STATE OF THE ART

An open distributed system is a category of distributed systems which are made up of components that may be obtained from a number of different sources, which together work as a single distributed system. The ODP model provides an application interface to the distributed system. In distributed computing, this model is called the virtual main frame and is enabled by distributed object technology, the virtual main frame being created from "componentare".

The present invention will be referred to the industry standard or open distributed processing, named Common Request Broker Architecture, CORBA, which in the present case will be used as a platform for test implementations.

However, in current distributed platforms, such as CORBA[ObjB], terminal mobility support is not addressed.

PROBLEMS RELATED TO PRIOR ART

Current distributed platforms cannot support terminal mobility and hence cannot be used in the design and implementation of mobile systems.

In current distributed environment, objects can interact with each other completely independent of where they are located, i.e. on the same machine or on different machines.

In the Figure 1, the objects CO1 and CO2 are located on two different machines or nodes, N1 and N2 but can still interact as they are located on the same machine The DPE (Distributed Processing Environment) is responsible of marshalling the operation request into messages, locating the addressed object, sending the message to the destination node, unmarshalling the request, delivering the request to the addressed object and returning the results to the requesting object. The network used for the transportation and conveyance of operation request is called kTN (kernel Transport Network) in TINA terminology [TIN94b]. This applies for fixed systems but not for mobile systems.

In mobile systems, there are numerous nodes that are mobile. These mobile node has special behaviour:

- It changes frequently the node with which it has direct link.

- It may just disappear from a node and reappear later at any other node.

The topology of the kernel Transport Network for such systems containing mobile DPE nodes is changing dynamically and more seriously, it can also be in an undetermined state in the sense that the connectivity with such a mobile DPE node is not always ensured unless additional functionally is inserted in the DPE. In such a mobile system, operational interactions are not guaranteed. Terminal mobility support functions are required.

OBJECTS OF THE INVENTION

An object of the present invention is to suggest a terminal mobility support which elevates the problems related to prior art.

Another object of the present invention is to suggest an arrangement whereby terminal mobility support is offered in distributed environment.

Still another object of the present invention is to provide an arrangement enabling the use of distributed environment in the design and implementation of mobile systems.

SUMMARY OF THE INVENTION

The above objects are achieved in an arrangement of the type as stated in the preamble, which according to the present invention is characterised by the features as stated in the present description and the appending patent claims.

Further features and advantages of the present invention will appear from the following description taken in conjunction with the appending drawings, as well as from the appending patent claims.

BRIEF DISCLOSURE OF THE DRAWINGS

Fig. 1 is a block diagram illustrating how object interactions in a distributed environment can take place.

Fig. 2 illustrates schematically an embodiment of the present invention, illustrating how the kernel Transport Network kTN may consist of fixed and mobile parts.

Fig. 3 is a block diagram illustrating how objects can be involved in operational interactions.

Fig. 4 is a schematical diagram illustrating how interactions may be initiated by a mobile part.

Fig. 5 is a schematical diagram illustrating how interactions are initiated by a fixed part.

DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1, as previously discussed, illustrates how object interactions in a distributed environment can take place in accordance with prior art, and wherein operational interactions are not guaranteed if this represents a mobile system.

Terminal mobility support functions are therefore required, and in the following there will be discussed embodiments according to the present invention wherein such terminal mobility support is introduced for distributed systems.

Accordingly, with reference to Fig. 2 and Fig. 3 an embodiment of the present invention will be discussed in detail, the proposed solution being based on a division of the kTN and the use of agents.

DIVISION OF THE kTN

We propose to consider the kTN as consisting of two parts:

- The fixed part comprising all fixed DPE nodes.
- The mobile part comprising all mobile DPE nodes.

At the boundary of the fixed part of the kTN there are several Network Access Points (NAP), i.e. points where mobile DPE node (terminals) can connect themselves to the fixed kTN.

An NAP object is introduced to represent a NAP on the kTN. An NAP object is an interceptor which stands at the

boundary of the terminal domain and the telecom system domain and is responsible for checking, transforming and forwarding of interactions that cross the boundary. An NAP object has two communication interfaces, one with the mobile DPE and one with the fixed kTN. Several NAPs can be located at the same DPE node.

Each mobile DPE node may have one or several Terminal Access Points (TAP), i.e. the points where the mobile DPE node can exchange operations with other DPE nodes. A TAP will be represented by a TAP object in the terminal domain

Prior to any operational interaction the mobile DPE, i.e. one of its TAPs, must be attached to an NAP. Operational interactions between a computational object residing on a mobile DPE and a computational object residing on a fixed DPE always go through a TAP and an NAP.

USE OF AGENTS

We introduced a Terminal_Agent Object (TA) to represent the mobile DPE node in the fixed part of the kTN. When the terminal (mobile DPE node) is moving, the NAP to which the TAP is connected may change from time to time. The TA unburden the requesting object on the fixed part (CO2 as shown in Figure 3). It keeps track of which is the current NAP.

On the mobile DPE node, we introduce a SPA object (Service Provider Agent) to represent the fixed part of a kTN that the mobile node is communicating with. The SPA is thus entrusted with two responsibilities: supporting security functions and keeping location information. In

this way, only one interceptor object is required in the terminal for managing both security and location updating. The introduction of the SPA is also convenient to keep the TAP hidden from the application objects. Instead of issuing an operation invocation to CO2, CO1 issues a request to the SPA. The reason is that a mobile DPE for example on a PABX may in fact have several TAPs which should be transparent to the application objects. The SPA will ensure this transparency.

INTERACTIONS INITIATED BY THE MOBILE PART

Figure 4 shows example of the request of an operation opX on CO2 by CO1. The request is packed inside an operation call(CO2.opX) on the SPA. The SPA on its turn invokes call(TA.call(CO2.opX) on the TAP. The TAP invokes call(TA.call(CO2.opX)) on the NAP. The TAP invokes call(CO2.opX) on the TA. Finally, the TA invokes opX on CO2. The operation results will be conveyed on the reciprocal way back to CO1.

INTERACTIONS INITIATED BY THE FIXED PART

Figure 5 shows an example of a request of an operation opY on CO1 initiated by CO2. The conveyance process is similar but reciprocal to the example above and we will not describe it again.

LOCATION REGISTRATION AND DEREGISTRATION

For interactions initiated by objects on the fixed side the success relies on two conditions. First, both the association between the TA and the NAP and the association between the NAP and TAP must be defined. If one or both

of the two associations are undefined, the interaction will be unsuccessful. Second, the two associations must be consistent with each other. If the TAP is associated with an instance of NAP, then the TA must be associated with the same instance of NAP. An inconsistency will lead to failure.

When the mobile DPE is moving, the TAP - NAP association and the NAP - TA association must change correlatively and may sometimes be undefined. The operations necessary to determine these two associations and to supply this information to the TA are commonly referred as location registration and location deregistration.

Such a location registration and deregistration procedure must be implemented but since there exists several methods we are not going describe them here.

MERITS OF THE INVENTION

- This invention offers terminal mobility support in distributed environment

- It is based on agent technology which yields high level of flexibility by allows numerous ways of implementing the Terminal_Agent (TA) and the Service_Provider_Agent (SPA). The internal implementation of these agents can also be modified without affecting the rest of the system.

- It enables the use of distributed environment in the design and implementation of mobile systems.

SPECIAL FEATURES OF THE PRESENT INVENTION CAN BE LISTED AS FOLLOWS:

1: A terminal mobility support is introduced for distributed system.

2: Such a terminal mobility support is characterised by the division of the kernel Transport Network into a fixed and a mobile part.

3: The mobile part comprises all the mobile terminals or mobile DPE node while the fixed part covers all the fixed machines or nodes.

4: Such a terminal mobility support is implemented by the use of two agents: One agent residing on the fixed part and representing the mobile node and another agent residing on the mobile node and representing the fixed part.

REFERENCES

[Objb] Object Management Group, Inc. The Common Object Request Broker: Architecture and Specification. Revision 2.0, July 1995.

[TIN94b] TINA-C. Engineering Modelling Concepts (DPE Kernel Specifications), November 1994.

Patent claims

1. Arrangement for improving availability of services in a communication system, especially a telecommunications system, said system comprising distributed hardware and software components which interact in order to provide services to one or more users,
characterized by introducing in said system a terminal mobility, for thereby enabling application availability including terminal mobility.

2. Arrangement as claimed in claim 1,
characterized in that said terminal mobility and the support thereof is introduced in any Open Distributed Processing (ODP) and/or any Common Request Broker Architecture (COBRA) system, or similar.

3. Arrangement as claimed in claim 1 or 2,
characterized in that the network used for transportation and conveyance of any operation request, i.e. here called kernel Transport Network, kTN, is divided into a fixed and a mobile part.

4. Arrangement as claimed in claim 3,
characterized in that the mobile part comprises all the mobile terminals or mobile DPE node while the fixed part covers all the fixed machines or nodes.

5. Arrangement as claimed in claim 1-4,
characterized in that said terminal mobility is supported by the introduction of two agents, one agent residing in the fixed part and representing the

mobile node and another agent residing on the mobile node and representing the fixed part.

6. Arrangement as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that at least one Network Access Point object, an NAP object, is introduced to represent a Network Access Point (NAP) on said kTN, said NAP object operating as an interceptor at the boundary of the terminal domain and the telecom system domain, and being responsible for checking, transforming and forwarding of interactions that cross the boundary.

7. Arrangement as claimed in claim 6,
c h a r a c t e r i z e d i n that any of said NAP objects may have two communication interfaces, one with the mobile DPE and one with the fixed kTN, and that several NAPs can be located at the same DPE node.

8. Arrangement as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that each mobile DPE node may have one or several Terminal Access Points, TAPs, and that a TAP may be represented by a TAP object in the terminal domain.

9. Arrangement as claimed in claim 6, 7 or 8,
c h a r a c t e r i z e d i n that any operational interactions between a computational object residing on a mobile DPE and a computational object residing on a fixed DPE, is always communicated through a TAP and an NAP.

10. Arrangement as claimed in any of the preceding claims,

characterized in that a Terminal Agent obejct, TA object, is introduced to represent the mobile DPE node in the fixed part of the kTN, and that on the mobile DPE node there is introduced a Service Provider Agent, SPA, to represent the fixed part of a kTN that the mobile node is communicating with.

11. Arrangement as claimed in claim 10, characterized in that said TA object is adapted to unburden the requesting object on the fixed part (CO2), and is adapted also to keep track of which is the current NAP.

12. Arrangement as claimed in claim 10, characterized in that said SPA is adapted to be entrusted with two responsibilities, i.e. supporting security functions and keeping location information, for thereby reducing the terminal requirement for managing both security and location updating to only one interceptor.

13. Arrangement as claimed in claim 12, characterized in that said SPA is adapted to keep the TAP hidden from the application objects, for thereby ensuring transparency therebetween.

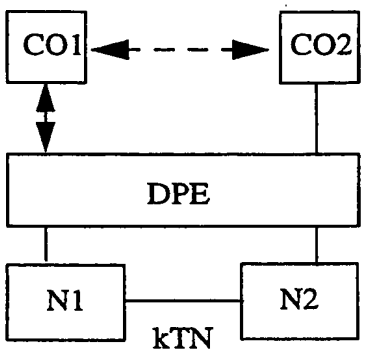

Figure 1 Object interactions in a Distributed Environment

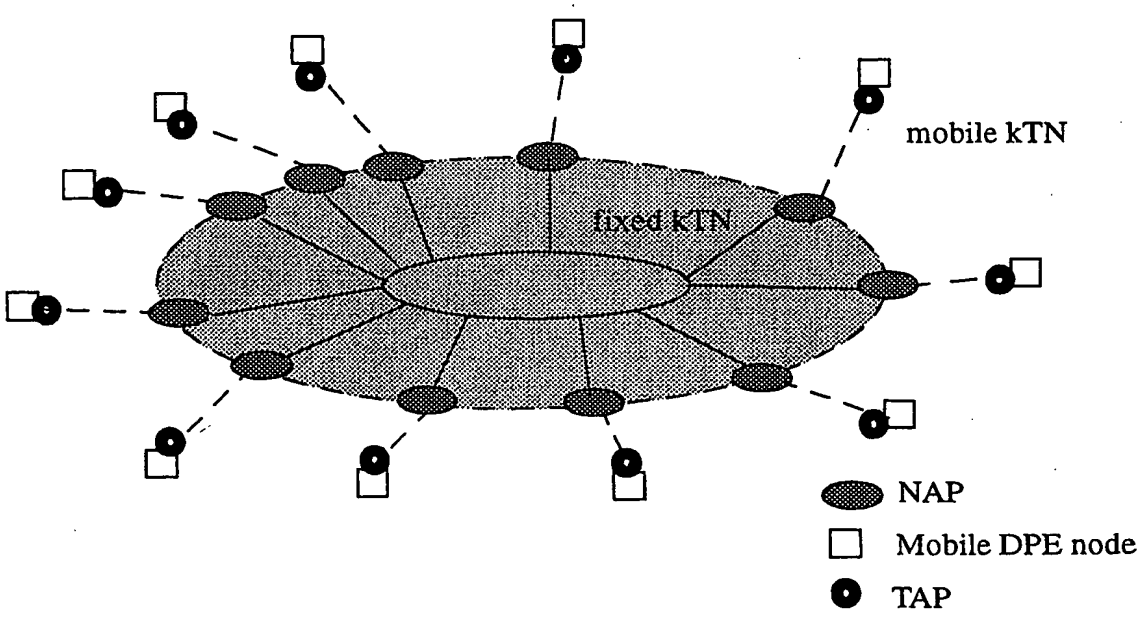

Figure 2 The kTN consisting of a fixed and a mobile part

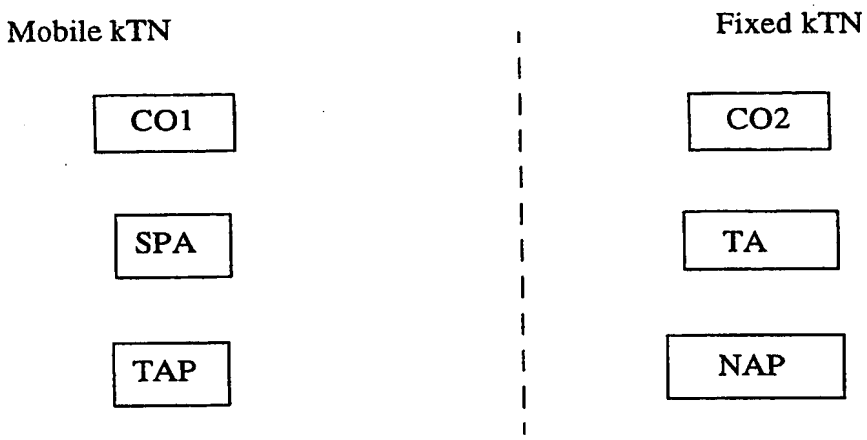

Figure 3 Objects involved in operational interactions

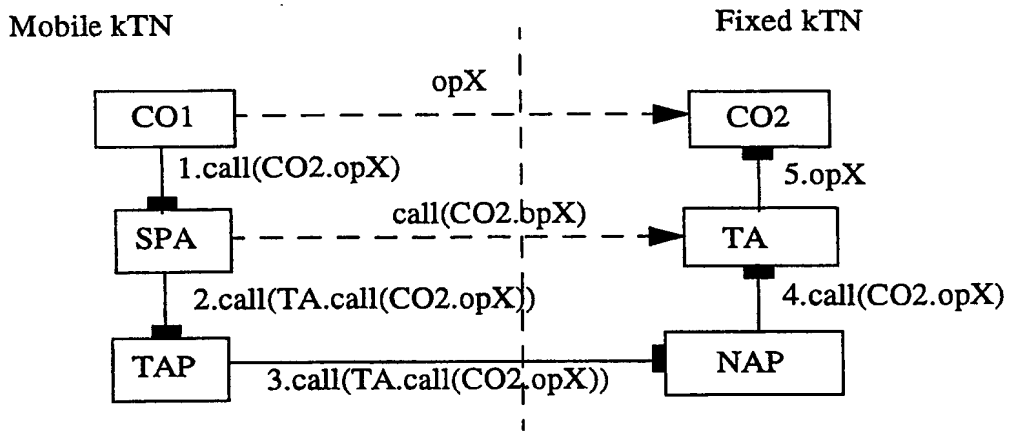

Figure 4 Interactions initiated by the mobile part

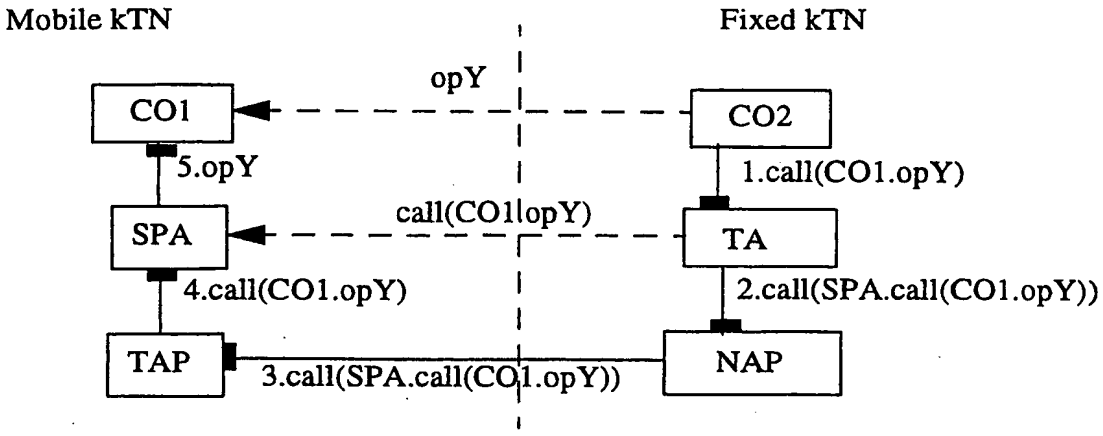

Figure 5 Interactions initiated by the fixed part